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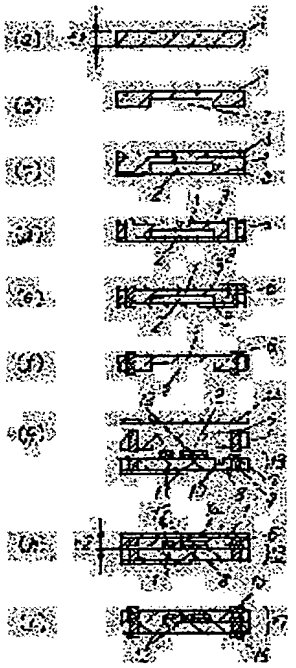
(54) CIRCUIT BOARD AND ITS MANUFACTURING METHOD

(57)Abstract:
PROBLEM TO BE SOLVED: To provide a method of manufacturing a circuit board having an inner via hole connection containing parts and an element.
SOLUTION: This method of manufacturing the circuit board includes a groove forming step of forming a groove 2 into a compressible insulating substrate 1, parts arranging step of arranging the parts and element 12 mounted on a parts mounting substrate 13 in an electrically connected state in the groove 2, and a curing step of causing the insulating substrate 1 to hold the parts and element 12 by reducing the width of the groove 2 while compressing the substrate 1 by heating and pressurizing the substrate 1. In the method, a via hole forming step of filling up via holes 5 formed after a releasable film 3 is stuck to at least one surface of the substrate 1 with conductive paste 6 and, thereafter, removing the film 3 is performed in a stage before the curing step.



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mounting substrate 13 in an electrically connected state in the groove 2, and a curing step of causing the insulating substrate 1 to hold the parts and element 12 by reducing the width of the groove 2 while compressing the substrate 1 by heating and pressurizing the substrate 1. In the method, a via hole forming step of filling up via holes 5 formed after a releasable film 3 is stuck to at least one surface of the substrate 1 with conductive paste 6 and, thereafter, removing the film 3 is performed in a stage before the curing step.

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* NOTICES *

CLAIMS

[Claim(s)]

[Claim 1] The recessing process which forms the slot of a larger configuration than the configuration of a components component in the predetermined location of the insulating base material which has compressibility-ed, Said components component which connected to said circuit pattern of an element-placement substrate with the circuit pattern which has conductivity electrically, and was carried on one [at least] field The components arrangement process which arranges inside said slot formed in said insulating base material, and carries out the laminating of said insulating base material to said element-placement substrate, The conductive paste which has the conductive matter with which the beer hall of said insulating base material was filled up Said components component is made to hold in the predetermined location of said insulating base material by micrifying said slot formed in the predetermined location of said insulating base material while carrying out heating pressurization of said insulating base material in the condition of having made said circuit pattern contacting and compressing said insulating base material in the resinous principle of the insulating base material concerned. The hardening process which carries out eburnation of said conductive matter of said conductive paste, and is electrically connected with said circuit pattern is included. Stick a mold-release characteristic film at least on one side of an insulating base material, and it is filled up with said conductive paste which has said conductive matter to said beer

hall formed to said mold-release characteristic film and said insulating base material. The beer formation process which exfoliates said mold-release characteristic film stuck on the account insulation base material of back to front is the manufacture approach of the circuit board which exists in a last process until it results in said hardening process.

[Claim 2] A recessing process is the manufacture approach of the circuit board according to claim 1 characterized by forming the slot of a larger configuration than the configuration of a components component in the predetermined location of the insulating base material realized from the insulating member of the shape of sheet metal of two or more sheets.

[Claim 3] A recessing process is the manufacture approach of the circuit board according to claim 1 characterized by forming the slot of a larger configuration than the configuration of a components component in the predetermined location of the insulating base material realized from the insulating member of the shape of sheet metal of two or more sheets containing the circuit board.

[Claim 4] A recessing process is the manufacture approach of the circuit board according to claim 1 characterized by forming the slot of a larger configuration than the configuration of a components component in the predetermined location of the insulating base material realized on one [at least] field from the insulating member of the shape of sheet metal of two or more sheets containing an element-placement substrate with the components component electrically connected to the circuit pattern which has conductivity.

[Claim 5] The conductive paste with which it filled up in the beer hall of an insulating base material and which has the conductive matter, In the circuit board by which said circuit pattern of the circuit board as a surface with the circuit pattern which has conductivity was electrically connected on one [at least] field The circuit board by which the components component was held in said slot or said through tube by micrifying the slot or through tube formed in the predetermined location of said insulating base material in the resinous principle of the insulating base material concerned.

[Claim 6] The conductive paste with which it filled up in the beer hall of an insulating base material and which has the conductive matter, In the circuit board by which said circuit pattern of the circuit board as a surface with the circuit pattern which has conductivity was electrically connected on one [at least] field By micrifying the slot or through tube formed in the location which adjoins the through tube formed in the predetermined location of said insulating base material at least, and said through tube of said circuit board which adjoins said insulating base material in the resinous principle of the insulating base material concerned The circuit board by which the components component was held in said slot of said circuit board which adjoins said insulating base material in said through tube of said insulating base material, or said through tube.

[Translation done.]

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.

2.**** shows the word which can not be translated.

3.In the drawings, any words are not translated.

DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Field of the Invention] This invention relates to the circuit board which has a components component inside, and its manufacture approach.

[0002]

[Description of the Prior Art] It does not remain in industrial use in connection with the miniaturization of electronic equipment, and densification in recent years, but in a noncommercial field, the finization to the circuit board was demanded strongly and the circuit board which has the inner beer hall connection which has a components component in the interior has been needed.

[0003] The manufacture approach of the conventional circuit board is explained below. Drawing 4 (a) - (f) is the process sectional view showing the manufacture approach of the conventional circuit board.

[0004] First, as shown in drawing 4 (a), the insulating base material 102 of the thickness tb equipped with the mold releasing films 101, such as polyester, is prepared for both sides. Next, as shown in drawing 4 (b), a through tube 103 is formed in the predetermined part of the insulating base material 102 using a laser beam etc. Next, as shown in drawing 4 (c), a through tube 103 is filled up with the conductive paste 104. At this time, the mold-release characteristic film 101 on top has played the role of a printing mask, and the role of the pollution control of the front face of the insulating base material 102. Next, the mold-release characteristic film 101 is exfoliated from both sides of the insulating base material 102. Next, as shown in drawing 4 (d), the metallic foils 105, such as copper foil, are stuck on both sides of the insulating base material 102. By carrying out heating pressurization in this condition, as shown in drawing 4 (e), the thickness of the insulating base material 102 is compressed into ta, and a metallic foil 105 is electrically connected with the conductive paste 104 by carrying out eburnation of the conductive matter of the conductive paste 104. The circuit board 107 is obtained by etching a metallic foil 105 alternatively and forming a circuit pattern 106, as furthermore shown in drawing 4 (f).

[0005]

[Problem(s) to be Solved by the Invention] However, it was difficult to offer the circuit board which has a components component inside by the manufacture approach of the circuit board mentioned above.

[0006] This invention can solve the technical problem of such a conventional

approach, and can offer the manufacture approach of the circuit board which has the inner beer hall connection which has a components component in the interior.
[0007]
[Means for Solving the Problem] The recessing process which forms the slot of a larger configuration than the configuration of a components component in the predetermined location of the insulating base material with which invention of this invention according to claim 1 has compressibility-ed, Said components component which connected to said circuit pattern of an element-placement substrate with the circuit pattern which has conductivity electrically, and was carried on one [at least] field The components arrangement process which arranges inside said slot formed in said insulating base material, and carries out the laminating of said insulating base material to said element-placement substrate, The conductive paste which has the conductive matter with which the beer hall of said insulating base material was filled up Said components component is made to hold in the predetermined location of said insulating base material by micrifying said slot formed in the predetermined location of said insulating base material while carrying out heating pressurization of said insulating base material in the condition of having made said circuit pattern contacting and compressing said insulating base material in the resinous principle of the insulating base material concerned. The hardening process which carries out eburnation of said conductive matter of said conductive paste, and is electrically connected with said circuit pattern is included. Stick a mold-release characteristic film at least on one side of an insulating base material, and it is filled up with said conductive paste which has said conductive matter to said beer hall formed to said mold-release characteristic film and said insulating base material. The exfoliating beer formation process said mold-release characteristic film stuck on the account insulation base material of back to front In order that it may be the manufacture approach of the circuit board which exists in a last process until it results in said hardening process and the slot of the predetermined location of an insulating base material may micrify in a hardening

process, While being able to hold the components component carried in the element-placement substrate by connecting electrically in the predetermined location of an insulating base material When the compressibility of an insulating base material increases, the conductive matter of a conductive paste carries out eburnation further, and electrical installation has an operation that the inner beer hall connection with firm high dependability is obtained.

[0008] Invention of this invention according to claim 2 has an operation that a recessing process can arrange a components component with height higher than the thickness of one sheet of an insulating member inside the circuit board by forming the slot of a larger configuration than the configuration of a components component in the predetermined location of the insulating base material realized from the insulating member of the shape of sheet metal of two or more sheets, in invention according to claim 1.

[0009] Invention of this invention according to claim 3 is set to invention according to claim 1. A recessing process Since the various circuit boards of various thickness can be used as an insulating member by forming the slot of a larger configuration than the configuration of a components component in the predetermined location of the insulating base material realized from the insulating member of the shape of sheet metal of two or more sheets containing the circuit board, It has an operation that a components component with high height can be freely arranged inside the circuit board.

[0010] Invention of this invention according to claim 4 is set to invention according to claim 1. A recessing process In the predetermined location of the insulating base material realized on one [at least] field from the insulating member of the shape of sheet metal of two or more sheets containing an element-placement substrate with the components component electrically connected to the circuit pattern which has conductivity By forming the slot of a larger configuration than the configuration of a components component, it has an operation that a components component can be arranged inside the circuit board to high density.

[0011] The conductive paste with which it filled up with invention of this invention according to claim 5 in the beer hall of an insulating base material and which has the conductive matter, In the circuit board by which said circuit pattern of the circuit board as a surface with the circuit pattern which has conductivity was electrically connected on one [at least] field By micrifying the slot or through tube formed in the predetermined location of said insulating base material in the resinous principle of the insulating base material concerned It is the circuit board which held the components component in the slot of an insulating base material, or the through tube, and when the compressibility of an insulating base material increases, it has an operation that the circuit board in which the conductive matter of a conductive paste carries out eburnation further, and electrical installation has the inner beer hall connection with firmer high dependability is obtained.

[0012] The conductive paste with which it filled up with invention of this invention according to claim 6 in the beer hall of an insulating base material and which has the conductive matter, In the circuit board by which said circuit pattern of the circuit board as a surface with the circuit pattern which has conductivity was electrically connected on one [at least] field By micrifying the slot or through tube formed in the location which adjoins the through tube formed in the predetermined location of said insulating base material at least, and said through tube of said circuit board which adjoins said insulating base material in the resinous principle of the insulating base material concerned When it is the circuit board held in the through tube of an insulating base material, and said slot of said adjoining circuit board or a through tube and the compressibility of an insulating base material increases a components component It has an operation that the circuit board in which the conductive matter of a conductive paste carries out eburnation further, and electrical installation has the inner beer hall connection with firmer high dependability is obtained.

[0013]

[Embodiment of the Invention] (Gestalt 1 of operation) Drawing 1 is the process

sectional view showing the production process of the circuit board in the gestalt 1 of operation of this invention which has a components component inside. First, the insulating base material 1 which has the compressibility-ed of thickness t1 as shown in drawing 1 (a) is prepared. The base material (an aramid-epoxy sheet is called below) which consists of composite which infiltrated the thermosetting epoxy resin into aromatic polyamide fiber, for example as this insulating base material 1 is used. Next, as shown in drawing 1 (b), a slot 2 is processed into the position of the aramid-epoxy sheet 1 using a laser beam etc. At this time, the configuration and the number of a slot 2 are arbitrary, may process which field of the aramid-epoxy sheet 1, and may process both sides. Moreover, you may be a through tube using metal mold, a laser beam, etc.

[0014] Next, as shown in drawing 1 (c), the mold-release characteristic films 3, such as polyester, are stuck on both sides of the aramid-epoxy sheet 1 using a heat press or a laminator. At this time, the mold-release characteristic film 3 may be only one side. Next, the through tube 5 which serves as a beer hall to the aramid-epoxy sheet 1 and the mold-release characteristic film 3 using a laser beam etc. as shown in drawing 1 (d) is formed. Next, as shown in drawing 1 (e), a through tube 5 is filled up with an epoxy resin and the conductive paste 6 containing metal powders, such as copper powder.

[0015] As an approach filled up with a conductive paste, the aramid-epoxy sheet 1 which has a through tube 5 is installed on the table of a printing machine (not shown), and a direct conductivity paste is printed from the mold-release characteristic film 3. At this time, the mold-release characteristic film 3 on top has played the role of a printing mask, and the role of the pollution control of the front face of the aramid-epoxy sheet 1. Next, as shown in drawing 1 (f), the mold-release characteristic film 3 is exfoliated from both sides of the aramid-epoxy sheet 1.

[0016] Next, as shown in drawing 1 (g), a circuit pattern 7 is formed in one field. Inner beer hall connection is made with another metallic foil 8 and conductive paste 9 of a field. And the element-placement substrate 13 with the components

component 12 which connected to the circuit pattern 11 which a slot 10 is processed and has conductivity electrically, and was carried is prepared. The aramid-epoxy sheet 1 with which the slot 2 was processed and the through tube 5 was filled up with the conductive paste 6 is laid on top of the element-placement substrate 13, and the metallic foils 14, such as copper foil, are further laid on top of another field of the aramid-epoxy sheet 1. It piles up so that the components component 12 may be arranged inside a slot 2, at the same time it contacts the conductive paste 6 in the circuit pattern 7 of the element-placement substrate 13 at this time.

[0017] Here, an element-placement substrate with a components component to the electrically connected general double-sided circuit board and the electrically connected multilayer substrate is sufficient as the element-placement substrate 13 by giving copper plating to a through hole. Moreover, the circuit board general instead of and the multilayer substrate which were laid on top of one field may be set in a product, and the element-placement substrate which carried the components component in the general circuit board or a multilayer substrate may be piled up. [a metallic foil 14]

[0018] Next, as shown in drawing 1 (h), while the epoxy resin and the conductive paste 6 which are one constituent of the aramid-epoxy sheet 1 by carrying out heating pressurization harden, the aramid-epoxy sheet 1, and the element-placement substrate 13 and a metallic foil 14 paste up. Moreover, in this process, the epoxy resin which is one constituent of the aramid-epoxy sheet 1 is extruded in slots 2 and 10, and contraction-izes slots 2 and 10. At this time, a slot 2 is completely filled with the epoxy resin which is one constituent of the aramid-epoxy sheet 1, and holds the components component 12 on the element-placement substrate 13. And by extruding to the epoxy resin fang furrows 2 and 10 which are one constituents of the aramid-epoxy sheet 1, the aramid-epoxy sheet 1 which has compressibility-ed from the first will be compressed further, and thickness is set to t2. By compressing the conductive paste 6 into coincidence, an epoxy resin is extruded from between the copper powder of the

conductive paste 6, copper powder carries out eburnation, and electric and mechanical association between copper powder and copper powder, and a metallic foil or between copper powder and a circuit pattern becomes firm.

[0019] In addition, there may not be the slot 2 of the aramid-epoxy sheet 1 in a part and the slot 10 of the element-placement substrate 13 of 12 components component which are not arranged inside. in addition -- for adjusting the amount extruded to the epoxy resin fang furrows 2 and 10 which are one constituents of the aramid-epoxy sheet 1 -- the configuration and the number of slots 2 and 10 -- or although it can respond according to heating pressurization conditions, resin like an epoxy resin prepared separately may be beforehand poured in moderately into a slot 2 and 10 before heating pressurization, for example.

[0020] Then, the four-layer circuit board 17 which built in the components component 12 is obtained by etching metallic foils 8 and 14 alternatively and forming circuit patterns 15 and 16, as shown in drawing 1 (i).

[0021] In addition, although the slot 2 was first processed to the aramid-epoxy sheet 1 with the gestalt of this operation after sticking the mold-release characteristic film 3 on the aramid-epoxy sheet 1, forming a through tube 5, being filled up with the conductive paste 6 and exfoliating the mold-release characteristic film 3 further After piling up the aramid-epoxy sheet 1 with which it filled up with the element-placement substrate 13 and the conductive paste 6, a slot 2 may be processed to the aramid-epoxy sheet 1.

[0022] Moreover, the multilayered circuit board of the Kota layer can be obtained by repeating the above-mentioned process to the pan which contained the components component.

[0023] In addition, although the element-placement substrate 13 which formed the circuit pattern 7 only in one side was used with the gestalt of this operation, the element-placement substrate which formed the circuit pattern in both sides beforehand may be used.

[0024] (Gestalt 2 of operation) Drawing 2 is the process sectional view showing the production process of the circuit board in the gestalt 2 of operation of this

invention which has a components component inside. First, the insulating base materials 18 and 19 which have the compressibility-ed of thickness t1 as shown in drawing 2 (a) are prepared. As these insulating base materials 18 and 19, an aramid-epoxy sheet is used, for example. Next, as shown in drawing 2 (b), slots 20 and 21 are processed into the position of the aramid-epoxy sheets 18 and 19 using a laser beam etc. At this time, the configuration and the number of slots 20 and 21 are arbitrary, may process which field of the aramid-epoxy sheets 18 and 19, and may process both sides. Moreover, you may be a through tube using metal mold, a laser beam, etc.

[0025] Next, as shown in drawing 2 (c), it has the 1st circuit pattern 22 and 2nd circuit pattern 23 on the front reverse side. Inner beer connection is made with the conductive paste 24, and slots 25 and 26 are processed. And a heat press and a laminator are used for both sides of the element-placement substrate 31 with the components components 29 and 30 which connected to the circuit patterns 27 and 28 which have conductivity electrically, and were carried, and the mold-release characteristic films 32, such as the aramid-epoxy sheets 18 and 19 and polyester, are stuck on them. At this time, it piles up so that the components components 29 and 30 may be arranged inside slots 20 and 21. Here, an element-placement substrate with a components component to the electrically connected general circuit board and the electrically connected multilayer substrate is sufficient as the element-placement substrate 31 by giving copper plating to a through hole. In addition, it is easy to be natural even if it sticks the aramid-epoxy sheet 18 and the mold-release characteristic film 32 only on one side of the element-placement substrate 31.

[0026] Next, as shown in drawing 2 (d), beer halls 34 and 35 are formed to the mold-release characteristic films 32, such as the aramid-epoxy sheets 18 and 19 and polyester, using a laser beam etc. At this time, beer halls 34 and 35 check the front face of the 1st circuit pattern 22 of the element-placement substrate 31, and the 2nd circuit pattern 23 by looking, and carry out hole processing. Next, as shown in drawing 2 R> 2 (e), beer halls 34 and 35 are filled up with an epoxy

resin and the conductive pastes 36 and 37 containing metal powders, such as copper powder. The element-placement substrate 31 which stuck the aramid-epoxy sheets 18 and 19 which have beer halls 34 and 35 as an approach filled up with the conductive pastes 36 and 37 is installed on the table of a printing machine (not shown), and a direct conductivity paste is printed from the mold-release characteristic film 32. At this time, the mold-release characteristic film 32 on top has played the role of a printing mask, and the role of the pollution control of the front face of the aramid-epoxy sheets 18 and 19. In addition, each process of the attachment of the aramid-epoxy sheets 18 and 19 to the element-placement substrate 31, hole processing of the beer halls 34 and 35 by the laser beam, the conductive paste 36 to beer halls 34 and 35, and restoration of 37 of whether it performs one side every or it performs to double-sided coincidence is arbitrary.

[0027] Next, as shown in drawing 2 (f), the mold-release characteristic film 32 is exfoliated from the aramid-epoxy sheets 18 and 19. Next, as shown in drawing 2 (g), the metallic foils 38 and 39, such as copper foil, are laid on top of the front face of the aramid-epoxy sheets 18 and 19 stuck on both sides of the element-placement substrate 31. By carrying out heating pressurization in this condition, as shown in drawing 2 (h), while the epoxy resin and the conductive pastes 36 and 37 which are one constituents of the aramid-epoxy sheets 18 and 19 are hardened, the aramid-epoxy sheets 18 and 19 and metallic foils 38 and 39 paste up. Moreover, in this process, the epoxy resin which is one constituent of the aramid-epoxy sheets 18 and 19 is extruded in slots 20 and 21 and slots 25 and 26, and contraction-izes slots 20 and 21 and slots 25 and 26. At this time, slots 20 and 21 hold the components components 29 and 30 on the element-placement substrate 31 by being completely filled with the epoxy resin which is one constituent of the aramid-epoxy sheets 18 and 19. And by extruding in the epoxy resin fang furrows 20 and 21 and slots 25 and 26 which are one constituents of the aramid-epoxy sheets 18 and 19, the aramid-epoxy sheets 18 and 19 which have compressibility-ed from the first will be compressed further,

and thickness is set to t2. By compressing the conductive pastes 36 and 37 into coincidence, an epoxy resin is extruded from between the copper powder of the conductive pastes 36 and 37, copper powder carries out eburnation, and association between copper powder and copper powder, and a metallic foil or between copper powder and a circuit pattern becomes firm.

[0028] In addition, there may not be the slots 20 and 21 of the aramid-epoxy sheets 18 and 19 of a part and the slots 25 and 26 of the element-placement substrate 31 of 29 and 30 components components which are not arranged inside.

[0029] Next, the four-layer circuit board 42 which built in the components components 29 and 30 can be obtained by etching metallic foils 38 and 39 alternatively and forming circuit patterns 40 and 41, as shown in drawing 2 (i).

[0030] Moreover, the multilayered circuit board of the Kota layer can be obtained by repeating the above-mentioned process to the pan which contained the components component.

[0031] (Gestalt 3 of operation) Drawing 3 is the process sectional view showing the production process of the circuit board in the gestalt 3 of operation of this invention which has a components component inside. First, the insulating base material 50 which has the compressibility-ed of thickness t1 as shown in drawing 3 (a) is prepared. As this insulating base material 50, an aramid-epoxy sheet is used, for example. Next, as shown in drawing 3 (b), a slot 51 is processed into the position of the aramid-epoxy sheet 50 using a laser beam etc. At this time, the configuration and the number of a slot 51 are arbitrary, may process which field of the aramid-epoxy sheet 50, and may process both sides. Moreover, you may be a through tube using metal mold, a laser beam, etc.

[0032] Next, as shown in drawing 3 (c), the mold-release characteristic films 52, such as polyester, are stuck on both sides of the aramid-epoxy sheet 50 using a heat press or a laminator. At this time, the mold-release characteristic film 52 may be only one side. Next, as shown in drawing 3 (d), a through tube 53 is formed to the aramid-epoxy sheet 50 and the mold-release characteristic film 52

using a laser beam etc.

[0033] Next, as shown in drawing 3 (e), a through tube 53 is filled up with an epoxy resin and the conductive paste 54 containing metal powders, such as copper powder. As an approach filled up with a conductive paste, the aramid-epoxy sheet 50 which has a through tube 53 is installed on the table of a printing machine (not shown), and a conductive paste is directly printed from the mold-release characteristic film 52. At this time, the mold-release characteristic film 52 on top has played the role of a printing mask, and the role of the pollution control of the front face of the aramid-epoxy sheet 50. Next, as shown in drawing 3 (f), the mold-release characteristic film 52 is exfoliated from both sides of the aramid-epoxy sheet 50.

[0034] The element-placement substrate 61 with the components component 60 which connected to the circuit pattern 59 which a circuit pattern 55 is formed in a field on the other hand as while shows drawing 3 (g), inner beer hall connection is made with another metallic foil 56 or circuit pattern 57, and conductive paste 58 of a field, and has conductivity electrically, and was carried is prepared. Next, as shown in drawing 3 (h), a slot 62 is processed into the position of the element-placement substrate 61 using a laser beam etc. At this time, the configuration and the number of a slot 62 may be arbitrary, and you may be a through tube using metal mold, a laser beam, etc.

[0035] Next, as shown in drawing 3 (i), the aramid-epoxy sheet 50 and the element-placement substrate 61 are piled up by turns. It piles up so that the components component 60 may be arranged inside slots 51 and 62, at the same time it joins the circuit patterns 55 and 57 of the element-placement substrate 61 to the conductive paste 54 at this time. Moreover, when the outermost layer becomes the aramid-epoxy sheet 50 by the number of sheets which piles up the aramid-epoxy sheet 50 and the element-placement substrate 61 by turns, metallic foils (not shown), such as copper foil, are laid on top of the pan of the aramid-epoxy sheet 50 of the outermost layer outside.

[0036] Next, as shown in drawing 3 (j), while the epoxy resin and the conductive

paste 54 which are one constituent of the aramid-epoxy sheet 50 by carrying out heating pressurization harden, the aramid-epoxy sheet 50 and the element-placement substrate 61 paste up. Moreover, in this process, the epoxy resin which is one constituent of the aramid-epoxy sheet 50 is extruded in slots 51 and 62, and contraction-izes slots 51 and 62. At this time, slots 51 and 62 are completely filled with the epoxy resin which is one constituent of the aramid-epoxy sheet 50, and hold the components component 60 on the element-placement substrate 61.

[0037] And by extruding to the epoxy resin fang furrows 51 and 62 which are one constituents of the aramid-epoxy sheet 50, the aramid-epoxy sheet 50 which has compressibility-ed from the first will be compressed further, and thickness is set to t2. By compressing the conductive paste 54 into coincidence, an epoxy resin is extruded from between the copper powder of the conductive paste 54, copper powder carries out eburnation, and association between copper powder and copper powder, and a metallic foil or between copper powder and a circuit pattern becomes firm. In addition, there may not be the slot 51 of the aramid-epoxy sheet 50 in a part and the slot 62 of the element-placement substrate 61 of 60 components component which are not arranged inside.

[0038] Then, the multilayered circuit board 64 which built in the components component 60 is obtained by etching a metallic foil 56 alternatively and forming a circuit pattern 63, as shown in drawing 3 (k).

[0039] Moreover, the multilayered circuit board of the Kota layer can be obtained by repeating the above-mentioned process to the pan which contained the components component.

[0040] In addition, although one side used for the outermost layer the element-placement substrate 61 covered by the metallic foil 56 with the gestalt of this operation, the element-placement substrate which formed the circuit pattern in both sides beforehand may be used.

[0041]

[Effect of the Invention] The recessing process at which this invention forms the

slot of a larger configuration than the configuration of a components component in the predetermined location of the insulating base material which has compressibility-ed as mentioned above, Said components component which connected to said circuit pattern of an element-placement substrate with the circuit pattern which has conductivity electrically, and was carried on one [at least] field The components arrangement process which arranges inside said slot formed in said insulating base material, and carries out the laminating of said insulating base material to said element-placement substrate, The conductive paste which has the conductive matter with which the beer hall of said insulating base material was filled up Said components component is made to hold in the predetermined location of said insulating base material by micrifying said slot formed in the predetermined location of said insulating base material while carrying out heating pressurization of said insulating base material in the condition of having made said circuit pattern contacting and compressing said insulating base material. And the hardening process which carries out eburnation of said conductive matter of said conductive paste, and is electrically connected with said circuit pattern is included. Stick a mold-release characteristic film at least on one side of an insulating base material, and it is filled up with said conductive paste which has said conductive matter to said beer hall formed to said mold-release characteristic film and said insulating base material. The exfoliating beer formation process said mold-release characteristic film stuck on the account insulation base material of back to front In order that it may be the manufacture approach of the circuit board which exists in a last process until it results in said hardening process and the slot of the predetermined location of an insulating base material may micrify in a hardening process, While being able to hold the components component carried in the element-placement substrate by connecting electrically in the predetermined location of an insulating base material When the compressibility of an insulating base material increases, the conductive matter of a conductive paste carries out eburnation further, and the inner beer hall connection with high dependability with firmer electrical installation

is obtained.

[0042] Moreover, this invention can arrange a components component with height higher than the thickness of one sheet of an insulating member inside a substrate in a recessing process by forming the slot of a larger configuration than the configuration of a components component in the predetermined location of the insulating base material realized from the insulating member of the shape of sheet metal of two or more sheets.

[0043] Moreover, in a recessing process, since the various circuit boards of various thickness can be used for this invention as an insulating member by forming the slot of a larger configuration than the configuration of a components component in the predetermined location of the insulating base material realized from the insulating member of the shape of sheet metal of two or more sheets containing the circuit board, it can arrange a components component with high height inside a substrate freely.

[0044] Furthermore, this invention can arrange a components component inside a substrate to high density in a recessing process by forming the slot of a larger configuration than the configuration of a components component in the predetermined location of the insulating base material realized on one [at least] field from the insulating member of the shape of sheet metal of two or more sheets containing an element-placement substrate with the components component electrically connected to the circuit pattern which has conductivity.

[0045] Moreover, the conductive paste with which it filled up with this invention in the beer hall of an insulating base material and which has the conductive matter, In the circuit board by which said circuit pattern of the circuit board as a surface with the circuit pattern which has conductivity was electrically connected on one [at least] field When the slot or through tube formed in the predetermined location of said insulating base material micrifies It is the circuit board which held said component in the slot of an insulating base material, or the through tube, and when the compressibility of an insulating base material increases, the circuit board in which the conductive matter of a conductive paste carries out eburnation

further, and electrical installation has the inner beer hall connection with firmer high dependability is obtained.

[0046] Furthermore, the conductive paste with which it filled up with this invention in the beer hall of an insulating base material and which has the conductive matter, In the circuit board by which said circuit pattern of the circuit board as a surface with the circuit pattern which has conductivity was electrically connected on one [at least] field When the slot or through tube formed in the location which adjoins the through tube formed in the predetermined location of said insulating base material at least and said through tube of said circuit board which adjoins said insulating base material micrifies When it is the circuit board held in the through tube of an insulating base material, and the slot of said adjoining circuit board or a through tube and the compressibility of an insulating base material increases a components component The circuit board in which the conductive matter of a conductive paste carries out eburnation further, and electrical installation has the inner beer hall connection with firmer high dependability is obtained.

[Translation done.]

* NOTICES *

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DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1] The process sectional view showing the production process of the circuit board in the gestalt 1 of operation of this invention which has a components component inside

[Drawing 2] The process sectional view showing the production process of the circuit board in the gestalt 2 of operation of this invention which has a components component inside

[Drawing 3] The process sectional view showing the production process of the circuit board in the gestalt 3 of operation of this invention which has a components component inside

[Drawing 4] The process sectional view showing the manufacture approach of the conventional circuit board

[Description of Notations]

1 Insulating Base Material (Aramid-Epoxy Sheet)

2 Slot

3 Mold-release Characteristic Film

5 Through Tube

6 Conductive Paste

7 Circuit Pattern

8 Metallic Foil

9 Conductive Paste

10 Slot

11 Circuit Pattern

12 Components Component

13 Element-Placement Substrate

14 Metallic Foil

15 Circuit Pattern

16 Circuit Pattern

17 Four-Layer Circuit Board

18 Insulating Base Material (Aramid-Epoxy Sheet)

19 Insulating Base Material (Aramid-Epoxy Sheet)

20 Slot

21 Slot

22 1st Circuit Pattern

23 2nd Circuit Pattern

24 Conductive Paste

25 Slot

26 Slot

27 Circuit Pattern

28 Circuit Pattern

29 Components Component

30 Components Component

31 Element-Placement Substrate

32 Mold-release Characteristic Film

34 Beer Hall

35 Beer Hall

36 Conductive Paste

37 Conductive Paste

38 Metallic Foil

39 Metallic Foil

40 Circuit Pattern

41 Circuit Pattern

42 Four-Layer Circuit Board

50 Insulating Base Material (Aramid-Epoxy Sheet)

51 Slot

52 Mold-release Characteristic Film

53 Through Tube

54 Conductive Paste

55 Circuit Pattern

56 Metallic Foil

57 Circuit Pattern

58 Conductive Paste

59 Circuit Pattern

60 Components Component

61 Element-Placement Substrate

62 Slot

63 Circuit Pattern

64 Multilayered Circuit Board

101 Mold-release Characteristic Film

102 Insulating Base Material

103 Through Tube

104 Conductive Paste

105 Metallic Foil

106 Circuit Pattern

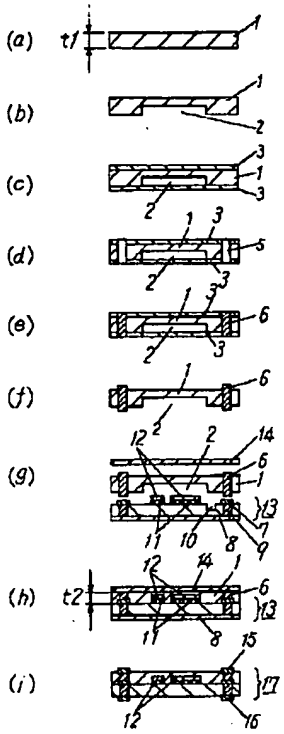
107 Circuit Board

[Translation done.]

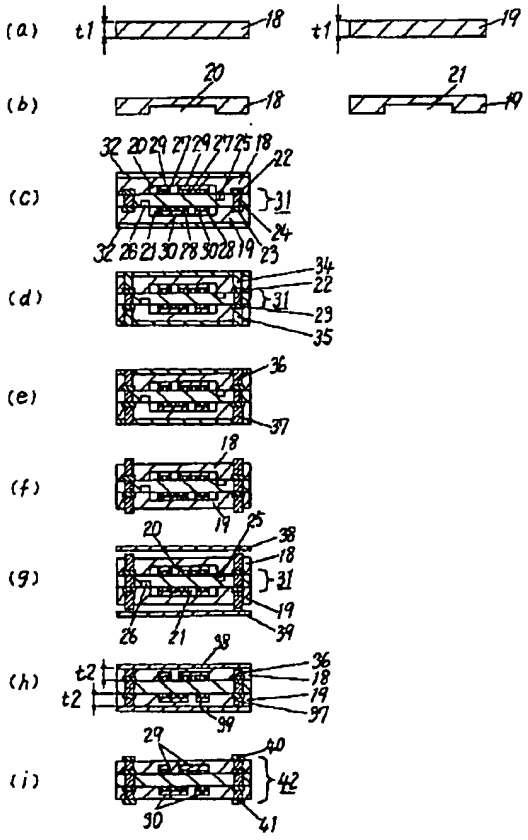
* NOTICES *

DRAWINGS

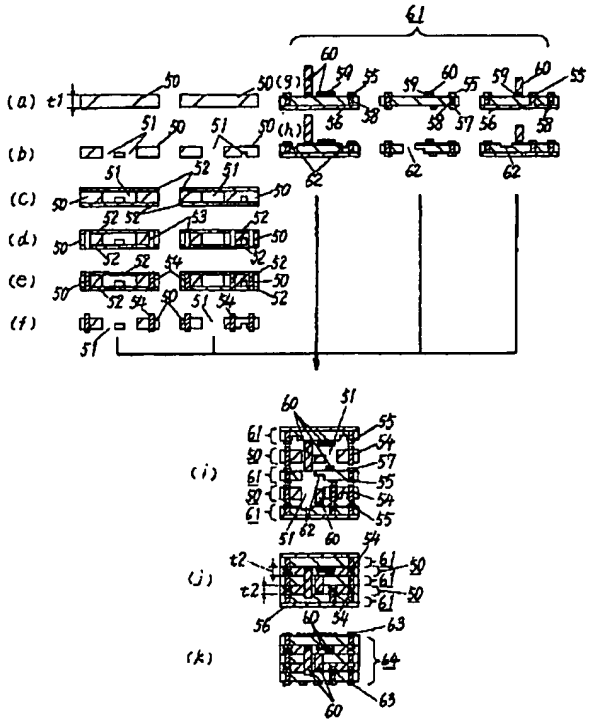
[Drawing 1]



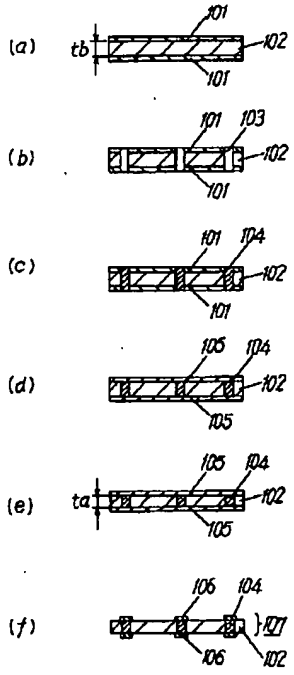
[Drawing 2]



[Drawing 3]



[Drawing 4]



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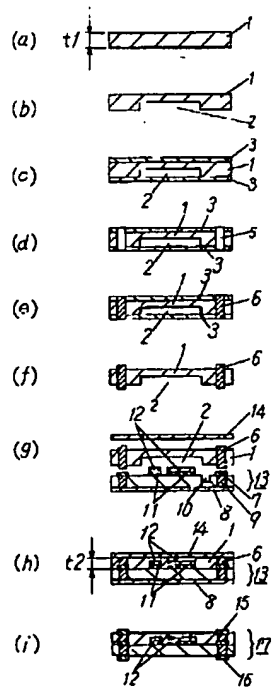
最終頁に続く

(54)【発明の名称】　回路基板およびその製造方法

(57)【要約】
【課題】　内部に部品素子を有するインナビアホール接続を持つ回路基板の製造方法を提供することを目的とする。
【解決手段】　被圧縮性を有する絶縁基材１に溝２を形成する溝加工工程と、部品搭載基板１３に電気的に接続して搭載した部品素子１２を、溝２の内部に配置する部品配置工程と、加熱加圧することで、絶縁基材１を圧縮しながら溝２を微小化することにより部品素子１２を絶縁基材１に保持させる硬化工程とを含み、基材１の少なくとも片面に離型性フィルム３を貼付後に形成したビアホール５に対し導電性ペースト６を充填し、その後離型性フィルム３を剥離するビア形成工程は、硬化工程に至るまでの前工程に存在する回路基板の製造方法である。



【特許請求の範囲】
【請求項１】　被圧縮性を有する絶縁基材の所定位置に部品素子の形状よりも大きい形状の溝を形成する溝加工工程と、導電性を有する配線パターンを少なくとも一方の面上に有した部品搭載基板の前記配線パターンに電気的に接続して搭載した前記部品素子を、前記絶縁基材に形成した前記溝の内部に配置し、前記絶縁基材を前記部品搭載基板に積層する部品配置工程と、前記絶縁基材のビアホールに充填した導電性物質を有する導電性ペーストを、前記配線パターンに当接させた状態で前記絶縁基材を加熱加圧し、前記絶縁基材を圧縮しながら前記絶縁基材の所定位置に形成した前記溝を当該絶縁基材の樹脂成分にて微小化することにより前記部品素子を前記絶縁基材の所定位置に保持させ、かつ、前記導電性ペーストの前記導電性物質を緻密化して前記配線パターンと電気的に接続する硬化工程とを含み、絶縁基材の少なくとも片面に離型性フィルムを貼付し、前記離型性フィルムと前記絶縁基材に対し形成した前記ビアホールに対し前記導電性物質を有する前記導電性ペーストを充填し、その後前記絶縁基材に貼付した前記離型性フィルムを剥離するビア形成工程は、前記硬化工程に至るまでの前工程に存在する回路基板の製造方法。
【請求項２】　溝加工工程は、複数枚の薄板状の絶縁部材より成り立つ絶縁基材の所定位置に、部品素子の形状よりも大きい形状の溝を形成することを特徴とする請求項１記載の回路基板の製造方法。
【請求項３】　溝加工工程は、回路基板を含む複数枚の薄板状の絶縁部材より成り立つ絶縁基材の所定位置に、部品素子の形状よりも大きい形状の溝を形成することを特徴とする請求項１記載の回路基板の製造方法。
【請求項４】　溝加工工程は、導電性を有する配線パターンに電気的に接続された部品素子を少なくとも一方の面上に有した部品搭載基板を含む複数枚の薄板状の絶縁部材より成り立つ絶縁基材の所定位置に、部品素子の形状よりも大きい形状の溝を形成することを特徴とする請求項１記載の回路基板の製造方法。
【請求項５】　絶縁基材のビアホール内に充填された、導電性物質を有する導電性ペーストと、導電性を有する配線パターンを少なくとも一方の面上に有した表層としての回路基板の前記配線パターンとが電気的に接続された回路基板において、前記絶縁基材の所定位置に形成した溝もしくは貫通孔が当該絶縁基材の樹脂成分にて微小化されることにより、前記溝もしくは前記貫通孔内に部品素子が保持された回路基板。
【請求項６】　絶縁基材のビアホール内に充填された、導電性物質を有する導電性ペーストと、導電性を有する配線パターンを少なくとも一方の面上に有した表層としての回路基板の前記配線パターンとが電気的に接続された回路基板において、少なくとも前記絶縁基材の所定位置に形成した貫通孔と、前記絶縁基材に隣接する前記回路基板の前記貫通孔に隣接する位置に形成した溝もしくは貫通孔が当該絶縁基材の樹脂成分にて微小化されることにより、前記絶縁基材の前記貫通孔内と前記絶縁基材に隣接する前記回路基板の前記溝もしくは前記貫通孔内に部品素子が保持された回路基板。
【発明の詳細な説明】
【０００１】
【発明の属する技術分野】本発明は、内部に部品素子を有する回路基板およびその製造方法に関するものである。
【０００２】
【従来の技術】近年、電子機器の小型化、高密度化に伴い、産業用にとどまらず民生用の分野において、回路基板に対するファイン化が強く要望され、内部に部品素子を有するインナビアホール接続を持つ回路基板が必要になってきた。
【０００３】以下従来の回路基板の製造方法について説明する。図４（ａ）～（ｆ）は従来の回路基板の製造方法を示す工程断面図である。
【０００４】まず、図４（ａ）に示すように、両面にポリエステルなどの離型フィルム１０１を備えた厚さｔｂの絶縁基材１０２を準備する。次に図４（ｂ）に示すように、絶縁基材１０２の所定の箇所にレーザ光などを利用して貫通孔１０３を形成する。次に図４（ｃ）に示すように、貫通孔１０３に導電性ペースト１０４を充填する。このとき、上面の離型性フィルム１０１は印刷マスクの役割と、絶縁基材１０２の表面の汚染防止の役割を果たしている。次に絶縁基材１０２の両面から離型性フィルム１０１を剥離する。次に図４（ｄ）に示すように、絶縁基材１０２の両面に銅箔などの金属箔１０５を貼付ける。この状態で加熱加圧することにより、図４（ｅ）に示すように、絶縁基材１０２の厚さはｔａに圧縮され、導電性ペースト１０４の導電性物質が緻密化されることにより導電性ペースト１０４と金属箔１０５を電気的に接続する。さらに図４（ｆ）に示すように金属箔１０５を選択的にエッチングして配線パターン１０６を形成することにより回路基板１０７が得られる。
【０００５】
【発明が解決しようとする課題】しかしながら、上述する回路基板の製造方法では、内部に部品素子を有する回路基板を提供することが困難であった。
【０００６】本発明はこのような従来方法の課題を解決するものであり、内部に部品素子を有するインナビアホール接続を持つ回路基板の製造方法を提供することができるものである。
【０００７】
【課題を解決するための手段】本発明の請求項１に記載の発明は、被圧縮性を有する絶縁基材の所定位置に部品素子の形状よりも大きい形状の溝を形成する溝加工工程と、導電性を有する配線パターンを少なくとも一方の面

上に有した部品搭載基板の前記配線パターンに電気的に接続して搭載した前記部品素子を、前記絶縁基材に形成した前記溝の内部に配置し、前記絶縁基材を前記部品搭載基板に積層する部品配置工程と、前記絶縁基材のビアホールに充填した導電性物質を有する導電性ペーストを、前記配線パターンに当接させた状態で前記絶縁基材を加熱加圧し、前記絶縁基材を圧縮しながら前記絶縁基材の所定位置に形成した前記溝を当該絶縁基材の樹脂成分にて微小化することにより前記部品素子を前記絶縁基材の所定位置に保持させ、かつ、前記導電性ペーストの前記導電性物質を緻密化して前記配線パターンと電気的に接続する硬化工程とを含み、絶縁基材の少なくとも片面に離型性フィルムを貼付し、前記離型性フィルムと前記絶縁基材に対し形成した前記ビアホールに対し前記導電性物質を有する前記導電性ペーストを充填し、その後前記絶縁基材に貼付した前記離型性フィルムを剥離するビア形成工程は、前記硬化工程に至るまでの前工程に存在する回路基板の製造方法であり、絶縁基材の所定位置の溝が硬化工程において微小化するため、部品搭載基板に電気的に接続して搭載された部品素子を絶縁基材の所定位置に保持することができると共に、絶縁基材の圧縮性が増すことにより、導電性ペーストの導電性物質がさらに緻密化して電気的接続が強固な信頼性の高いインナビアホール接続が得られるという作用を有する。

【０００８】本発明の請求項２に記載の発明は、請求項１記載の発明において、溝加工工程は、複数枚の薄板状の絶縁部材より成り立つ絶縁基材の所定位置に、部品素子の形状よりも大きい形状の溝を形成することにより、絶縁部材の１枚の厚みより高さが高い部品素子を回路基板内部に配置することができるという作用を有する。

【０００９】本発明の請求項３に記載の発明は、請求項１記載の発明において、溝加工工程は、回路基板を含む複数枚の薄板状の絶縁部材より成り立つ絶縁基材の所定位置に、部品素子の形状よりも大きい形状の溝を形成することにより、各種厚みの各種回路基板を絶縁部材として用いることができるため、高さが高い部品素子を自由に回路基板内部に配置することができるという作用を有する。

【００１０】本発明の請求項４に記載の発明は、請求項１記載の発明において、溝加工工程は、導電性を有する配線パターンに電気的に接続された部品素子を少なくとも一方の面上に有した部品搭載基板を含む複数枚の薄板状の絶縁部材より成り立つ絶縁基材の所定位置に、部品素子の形状よりも大きい形状の溝を形成することにより、部品素子を高密度に回路基板内部に配置することができるという作用を有する。

【００１１】本発明の請求項５に記載の発明は、絶縁基材のビアホール内に充填された、導電性物質を有する導電性ペーストと、導電性を有する配線パターンを少なくとも一方の面上に有した表層としての回路基板の前記配線パターンとが電気的に接続された回路基板において、前記絶縁基材の所定位置に形成した溝もしくは貫通孔が当該絶縁基材の樹脂成分にて微小化されることにより、部品素子を絶縁基材の溝もしくは貫通孔内に保持した回路基板であり、絶縁基材の圧縮性が増すことにより、導電性ペーストの導電性物質がさらに緻密化して電気的接続がより強固な信頼性の高いインナビアホール接続を持つ回路基板が得られるという作用を有する。

【００１２】本発明の請求項６に記載の発明は、絶縁基材のビアホール内に充填された、導電性物質を有する導電性ペーストと、導電性を有する配線パターンを少なくとも一方の面上に有した表層としての回路基板の前記配線パターンとが電気的に接続された回路基板において、少なくとも前記絶縁基材の所定位置に形成した貫通孔と、前記絶縁基材に隣接する前記回路基板の前記貫通孔に隣接する位置に形成した溝もしくは貫通孔が当該絶縁基材の樹脂成分にて微小化されることにより、部品素子を絶縁基材の貫通孔と、隣接する前記回路基板の前記溝もしくは貫通孔内に保持した回路基板であり、絶縁基材の圧縮性が増すことにより、導電性ペーストの導電性物質がさらに緻密化して電気的接続がより強固な信頼性の高いインナビアホール接続を持つ回路基板が得られるという作用を有する。

【００１３】

【発明の実施の形態】（実施の形態１）図１は本発明の実施の形態１における、内部に部品素子を有する回路基板の製造工程を示す工程断面図である。まず、図１（ａ）に示すように厚さｔ１の被圧縮性を持つ絶縁基材１を準備する。この絶縁基材１としては、例えば芳香族ポリアミド繊維に熱硬化性エポキシ樹脂を含浸させた複合材からなる基材（以下アラミド－エポキシシートと称する）が用いられる。次に図１（ｂ）に示すようにアラミド－エポキシシート１の所定の位置にレーザ光などを利用して溝２を加工する。このとき溝２の形状や個数は任意であり、アラミド－エポキシシート１のどちらの面に加工してもかまわないし、両面に加工してもよい。また、金型やレーザ光等を利用した貫通孔であってもよい。

【００１４】次に図１（ｃ）に示すように熱プレスやラミネータを用いて、ポリエステルなどの離型性フィルム３をアラミド－エポキシシート１の両面に貼付ける。このとき離型性フィルム３は片面のみであってもかまわない。次に図１（ｄ）に示すようにレーザ光などを利用してアラミド－エポキシシート１と離型性フィルム３に対してビアホールとなる貫通孔５を設ける。次に図１（ｅ）に示すように、貫通孔５に例えばエポキシ樹脂と銅粉等の金属粉を含む導電性ペースト６を充填する。

【００１５】導電性ペーストを充填する方法としては、貫通孔５を有するアラミド－エポキシシート１を印刷機（図示せず）のテーブル上に設置し、直接導電性ペース

トを離型性フィルム３の上から印刷する。このとき、上面の離型性フィルム３は印刷マスクの役割と、アラミドーエポキシシート１の表面の汚染防止の役割を果たしている。次に図１（ｆ）に示すようにアラミドーエポキシシート１の両面から離型性フィルム３を剥離する。

【００１６】次に図１（ｇ）に示すように、配線パターン７が一方の面に形成され、もう一方の面の金属箔８と導電性ペースト９によってインナビアホール接続され、かつ、溝１０が加工され、かつ、導電性を有する配線パターン１１に電気的に接続して搭載した部品素子１２を有した部品搭載基板１３を準備し、溝２が加工され貫通孔５に導電性ペースト６が充填されたアラミドーエポキシシート１を部品搭載基板１３に重ね合わせ、さらにアラミドーエポキシシート１のもう一方の面には例えば銅箔などの金属箔１４を重ね合わせる。このとき、導電性ペースト６に部品搭載基板１３の配線パターン７を当接すると同時に、溝２の内部に部品素子１２を配置するように重ね合わせる。

【００１７】ここで、部品搭載基板１３はスルーホールに銅めっきを施すことにより電気的に接続した一般の両面回路基板や多層基板に部品素子を有した部品搭載基板でもよい。また、一方の面に重ね合わせた金属箔１４のかわりに一般の回路基板や多層基板を積ね合わせてもかまわないし、一般の回路基板や多層基板に部品素子を搭載した部品搭載基板を重ね合わせてもかまわない。

【００１８】次に、図１（ｈ）に示すように、加熱加圧することにより、アラミドーエポキシシート１の一構成成分であるエポキシ樹脂および導電性ペースト６が硬化すると共に、アラミドーエポキシシート１と部品搭載基板１３、金属箔１４とが接着される。また、この工程において、アラミドーエポキシシート１の一構成成分であるエポキシ樹脂は溝２，１０へ押し出され、溝２，１０を縮小化する。このとき溝２はアラミドーエポキシシート１の一構成成分であるエポキシ樹脂で完全に満たされることで、部品搭載基板１３上の部品素子１２を保持する。そして、アラミドーエポキシシート１の一構成成分であるエポキシ樹脂が溝２，１０へ押し出されることにより、もともと被圧縮性を持つアラミドーエポキシシート１はさらに圧縮されることになり、厚さはｔ２になる。同時に導電性ペースト６も圧縮されることにより、導電性ペースト６の銅粉間からエポキシ樹脂が押し出されて銅粉が緻密化し、銅粉同士および銅粉と金属箔間、もしくは銅粉と配線パターン間の電気的および機械的結合が強固になる。

【００１９】なお、部品素子１２が内部に配置されない部分でのアラミドーエポキシシート１の溝２と部品搭載基板１３の溝１０は無くてもかまわない。なお、アラミドーエポキシシート１の一構成成分であるエポキシ樹脂が溝２，１０へ押し出される量を調整するには、溝２，１０の形状や個数により、もしくは、加熱加圧条件により対応が可能であるが、別途準備した例えばエポキシ樹脂のような樹脂等を、加熱加圧前にあらかじめ溝２，１０内へ適度に注入しておいてもよい。

【００２０】その後、図１（ｉ）に示すように金属箔８，１４を選択的にエッチングして配線パターン１５，１６を形成することにより、部品素子１２を内蔵した４層回路基板１７が得られる。

【００２１】なお、本実施の形態では、溝２をアラミドーエポキシシート１に対して最初に加工したが、アラミドーエポキシシート１に離型性フィルム３を貼付けて貫通孔５を設け、さらに導電性ペースト６を充填後に離型性フィルム３を剥離した後、もしくは、部品搭載基板１３と導電性ペースト６が充填されたアラミドーエポキシシート１を重ね合わせた後に、溝２をアラミドーエポキシシート１に対して加工してもかまわない。

【００２２】また、上記の工程を繰り返すことにより、部品素子を内蔵したさらに高多層の多層回路基板を得ることができる。

【００２３】なお、本実施の形態では、片面のみに配線パターン７を形成した部品搭載基板１３を用いたが、あらかじめ両面に配線パターンを形成した部品搭載基板を用いてもかまわない。

【００２４】（実施の形態２）図２は本発明の実施の形態２における、内部に部品素子を有する回路基板の製造工程を示す工程断面図である。まず、図２（ａ）に示すように厚さｔ１の被圧縮性を持つ絶縁基材１８，１９を準備する。この絶縁基材１８，１９としては、例えばアラミドーエポキシシートが用いられる。次に図２（ｂ）に示すようにアラミドーエポキシシート１８，１９の所定の位置にレーザ光などを利用して溝２０，２１を加工する。このとき溝２０，２１の形状や個数は任意であり、アラミドーエポキシシート１８，１９のどちらの面に加工してもかまわないし、両面に加工してもよい。また、金型やレーザ光等を利用した貫通孔であってもよい。

【００２５】次に図２（ｃ）に示すように、第１の配線パターン２２と第２の配線パターン２３を表裏に有し、導電性ペースト２４によりインナービア接続され、かつ、溝２５，２６が加工され、かつ、導電性を有する配線パターン２７，２８に電気的に接続して搭載した部品素子２９，３０を有した部品搭載基板３１の両面に、アラミドーエポキシシート１８，１９とポリエステルなどの離型性フィルム３２を熱プレスやラミネータを用いて貼付ける。このとき、溝２０，２１の内部に部品素子２９，３０を配置するように重ね合わせる。ここで、部品搭載基板３１はスルーホールに銅めっきを施すことにより電気的に接続した一般の回路基板や多層基板に部品素子を有した部品搭載基板でもよい。なお、部品搭載基板３１の片面のみにアラミドーエポキシシート１８と離型性フィルム３２を貼付けてももちろんよい。

【００２６】次に図２（ｄ）に示すようにレーザ光などを利用してアラミドーエポキシシート１８，１９とポリエステルなどの離型性フィルム３２に対してビアホール３４，３５を設ける。このとき、ビアホール３４，３５は部品搭載基板３１の第１の配線パターン２２と第２の配線パターン２３の表面を視認して穴加工する。次に図２（ｅ）に示すように、ビアホール３４，３５には例えばエポキシ樹脂と銅粉等の金属粉を含む導電性ペースト３６，３７を充填する。導電性ペースト３６，３７を充填する方法としては、ビアホール３４，３５を有するアラミドーエポキシシート１８，１９を貼付けた部品搭載基板３１を印刷機（図示せず）のテーブル上に設置し、直接導電性ペーストを離型性フィルム３２の上から印刷する。このとき、上面の離型性フィルム３２は印刷マスクの役割と、アラミドーエポキシシート１８，１９の表面の汚染防止の役割を果たしている。なお、部品搭載基板３１に対するアラミドーエポキシシート１８，１９の貼付け、レーザ光によるビアホール３４，３５の穴加工、ビアホール３４，３５への導電性ペースト３６，３７の充填の各工程は、片面ずつ実行するか、両面同時に実行するかは任意である。

【００２７】次に図２（ｆ）に示すようにアラミドーエポキシシート１８，１９から離型性フィルム３２を剥離する。次に図２（ｇ）に示すように、部品搭載基板３１の両面に貼付けたアラミドーエポキシシート１８，１９の表面に銅箔などの金属箔３８，３９を重ね合わせる。この状態で加熱加圧することにより、図２（ｈ）に示すように、アラミドーエポキシシート１８，１９の一構成成分であるエポキシ樹脂および導電性ペースト３６，３７が硬化されるとともにアラミドーエポキシシート１８，１９と金属箔３８，３９とが接着される。また、この工程において、アラミドーエポキシシート１８，１９の一構成成分であるエポキシ樹脂は溝２０，２１および溝２５，２６へ押し出され、溝２０，２１および溝２５，２６を縮小化する。このとき溝２０，２１はアラミドーエポキシシート１８，１９の一構成成分であるエポキシ樹脂で完全に満たされることで部品搭載基板３１上の部品素子２９，３０を保持する。そして、アラミドーエポキシシート１８，１９の一構成成分であるエポキシ樹脂が溝２０，２１および溝２５，２６へ押し出されることにより、もともと被圧縮性を持つアラミドーエポキシシート１８，１９はさらに圧縮されることになり、厚さはｔ２になる。同時に導電性ペースト３６，３７も圧縮されることにより、導電性ペースト３６，３７の銅粉間からエポキシ樹脂が押し出されて銅粉が緻密化し、銅粉同士および銅粉と金属箔間、もしくは銅粉と配線パターン間の結合が強固になる。

【００２８】なお、部品素子２９，３０が内部に配置されない部分のアラミドーエポキシシート１８，１９の溝２０，２１と部品搭載基板３１の溝２５，２６は無くてもかまわない。

【００２９】次に図２（ｉ）に示すように金属箔３８，３９を選択的にエッチングして配線パターン４０，４１を形成することにより、部品素子２９，３０を内蔵した４層回路基板４２を得ることができる。

【００３０】また、上記の工程を繰り返すことにより、部品素子を内蔵したさらに高多層の多層回路基板を得ることができる。

【００３１】（実施の形態３）図３は本発明の実施の形態３における、内部に部品素子を有する回路基板の製造工程を示す工程断面図である。まず、図３（ａ）に示すように厚さｔ１の被圧縮性を持つ絶縁基材５０を準備する。この絶縁基材５０としては、例えばアラミドーエポキシシートが用いられる。次に図３（ｂ）に示すようにアラミドーエポキシシート５０の所定の位置にレーザ光などを利用して溝５１を加工する。このとき溝５１の形状や個数は任意であり、アラミドーエポキシシート５０のどちらの面に加工してもかまわないし、両面に加工してもよい。また、金型やレーザ光等を利用した貫通孔であってもよい。

【００３２】次に図３（ｃ）に示すように熱プレスやラミネータを用いて、ポリエステルなどの離型性フィルム５２をアラミドーエポキシシート５０の両面に貼付ける。このとき離型性フィルム５２は片面のみであってもかまわない。次に図３（ｄ）に示すようにレーザ光などを利用してアラミドーエポキシシート５０と離型性フィルム５２に対して貫通孔５３を設ける。

【００３３】次に図３（ｅ）に示すように、貫通孔５３に例えばエポキシ樹脂と銅粉等の金属粉を含む導電性ペースト５４を充填する。導電性ペーストを充填する方法としては、貫通孔５３を有するアラミドーエポキシシート５０を印刷機（図示せず）のテーブル上に設置し、直接、導電性ペーストを離型性フィルム５２の上から印刷する。このとき、上面の離型性フィルム５２は印刷マスクの役割と、アラミドーエポキシシート５０の表面の汚染防止の役割を果たしている。次に図３（ｆ）に示すようにアラミドーエポキシシート５０の両面から離型性フィルム５２を剥離する。

【００３４】一方、図３（ｇ）に示すように一方の面に配線パターン５５が形成され、もう一方の面の金属箔５６もしくは配線パターン５７と導電性ペースト５８によってインナビアホール接続され、かつ、導電性を有する配線パターン５９に電気的に接続して搭載した部品素子６０を有した部品搭載基板６１を用意する。次に、図３（ｈ）に示すように、部品搭載基板６１の所定の位置にレーザ光などを利用して溝６２を加工する。このとき溝６２の形状や個数は任意であり、金型やレーザ光等を利用した貫通孔であってもよい。

【００３５】次に図３（ｉ）に示すように、アラミドーエポキシシート５０と部品搭載基板６１を交互に重ね合

わせる。このとき、導電性ペースト５４に部品搭載基板６１の配線パターン５５，５７を接合すると同時に、溝５１，６２の内部に部品素子６０を配置するように重ね合わせる。また、アラミド－エポキシシート５０と部品搭載基板６１を交互に重ね合わせる枚数により、最外層がアラミド－エポキシシート５０になるときは、銅箔などの金属箔（図示せず）を最外層のアラミド－エポキシシート５０のさらに外側に重ね合わせる。

【００３６】次に図３（ｊ）に示すように、加熱加圧することにより、アラミド－エポキシシート５０の一構成成分であるエポキシ樹脂および導電性ペースト５４が硬化すると共に、アラミド－エポキシシート５０と部品搭載基板６１が接着される。また、この工程において、アラミド－エポキシシート５０の一構成成分であるエポキシ樹脂は溝５１，６２へ押し出され、溝５１，６２を縮小化する。このとき溝５１，６２はアラミド－エポキシシート５０の一構成成分であるエポキシ樹脂で完全に満たされることで、部品搭載基板６１上の部品素子６０を保持する。

【００３７】そして、アラミド－エポキシシート５０の一構成成分であるエポキシ樹脂が溝５１，６２へ押し出されることにより、もともと被圧縮性を持つアラミド－エポキシシート５０はさらに圧縮されることになり、厚さはｔ２になる。同時に導電性ペースト５４も圧縮されることにより、導電性ペースト５４の銅粉間からエポキシ樹脂が押し出されて銅粉が緻密化し、銅粉同士および銅粉と金属箔間、もしくは銅粉と配線パターン間の結合が強固になる。なお、部品素子６０が内部に配置されない部分でのアラミド－エポキシシート５０の溝５１と部品搭載基板６１の溝６２は無くてもかまわない。

【００３８】その後、図３（ｋ）に示すように金属箔５６を選択的にエッチングして配線パターン６３を形成することにより、部品素子６０を内蔵した多層回路基板６４が得られる。

【００３９】また、上記の工程を繰り返すことにより、部品素子を内蔵したさらに高多層の多層回路基板を得ることができる。

【００４０】なお、本実施の形態では、最外層に片面が金属箔５６で覆われた部品搭載基板６１を用いたが、あらかじめ両面に配線パターンを形成した部品搭載基板を用いてもかまわない。

【００４１】

【発明の効果】以上のように本発明は、被圧縮性を有する絶縁基材の所定位置に部品素子の形状よりも大きい形状の溝を形成する溝加工工程と、導電性を有する配線パターンを少なくとも一方の面上に有した部品搭載基板の前記配線パターンに電気的に接続して搭載した前記部品素子を、前記絶縁基材に形成した前記溝の内部に配置し、前記絶縁基材を前記部品搭載基板に積層する部品配置工程と、前記絶縁基材のビアホールに充填した導電性物質を有する導電性ペーストを、前記配線パターンに当接させた状態で前記絶縁基材を加熱加圧し、前記絶縁基材を圧縮しながら前記絶縁基材の所定位置に形成した前記溝を微小化することにより前記部品素子を前記絶縁基材の所定位置に保持させ、かつ、前記導電性ペーストの前記導電性物質を緻密化して前記配線パターンと電気的に接続する硬化工程とを含み、絶縁基材の少なくとも片面に離型性フィルムを貼付し、前記離型性フィルムと前記絶縁基材に対し形成した前記ビアホールに対し前記導電性物質を有する前記導電性ペーストを充填し、その後前記絶縁基材に貼付した前記離型性フィルムを剥離するビア形成工程は、前記硬化工程に至るまでの前工程に存在する回路基板の製造方法であり、絶縁基材の所定位置の溝が硬化工程において微小化するため、部品搭載基板に電気的に接続して搭載された部品素子を絶縁基材の所定位置に保持することができると共に、絶縁基材の圧縮性が増すことにより、導電性ペーストの導電性物質がさらに緻密化して電気的接続がより強固な信頼性の高いインナビアホール接続が得られる。

【００４２】また、本発明は、溝加工工程において、複数枚の薄板状の絶縁部材より成り立つ絶縁基材の所定位置に、部品素子の形状よりも大きい形状の溝を形成することにより、絶縁部材の１枚の厚みより高さが高い部品素子を基板内部に配置することができる。

【００４３】また、本発明は、溝加工工程において、回路基板を含む複数枚の薄板状の絶縁部材より成り立つ絶縁基材の所定位置に、部品素子の形状よりも大きい形状の溝を形成することにより、各種厚みの各種回路基板を絶縁部材として用いることができるため、高さが高い部品素子を自由に基板内部に配置することができる。

【００４４】さらに、本発明は、溝加工工程において、導電性を有する配線パターンに電気的に接続された部品素子を少なくとも一方の面上に有した部品搭載基板を含む複数枚の薄板状の絶縁部材より成り立つ絶縁基材の所定位置に、部品素子の形状よりも大きい形状の溝を形成することにより、部品素子を高密度に基板内部に配置することができる。

【００４５】また、本発明は、絶縁基材のビアホール内に充填された、導電性物質を有する導電性ペーストと、導電性を有する配線パターンを少なくとも一方の面上に有した表層としての回路基板の前記配線パターンとが電気的に接続された回路基板において、前記絶縁基材の所定位置に形成した溝もしくは貫通孔が微小化することにより、前記素子を絶縁基材の溝もしくは貫通孔内に保持した回路基板であり、絶縁基材の圧縮性が増すことにより、導電性ペーストの導電性物質がさらに緻密化して電気的接続がより強固な信頼性の高いインナビアホール接続を持つ回路基板が得られる。

【００４６】さらに、本発明は、絶縁基材のビアホール内に充填された、導電性物質を有する導電性ペースト

と、導電性を有する配線パターンを少なくとも一方の面上に有した表層としての回路基板の前記配線パターンとが電気的に接続された回路基板において、少なくとも前記絶縁基材の所定位置に形成した貫通孔と、前記絶縁基材に隣接する前記回路基板の前記貫通孔に隣接する位置に形成した溝もしくは貫通孔が微小化することにより、部品素子を絶縁基材の貫通孔と、隣接する前記回路基板の溝もしくは貫通孔内に保持した回路基板であり、絶縁基材の圧縮性が増すことにより、導電性ペーストの導電性物質がさらに緻密化して電気的接続がより強固な信頼性の高いインナビアホール接続を持つ回路基板が得られる。

【図面の簡単な説明】

【図１】本発明の実施の形態１における、内部に部品素子を有する回路基板の製造工程を示す工程断面図

【図２】本発明の実施の形態２における、内部に部品素子を有する回路基板の製造工程を示す工程断面図

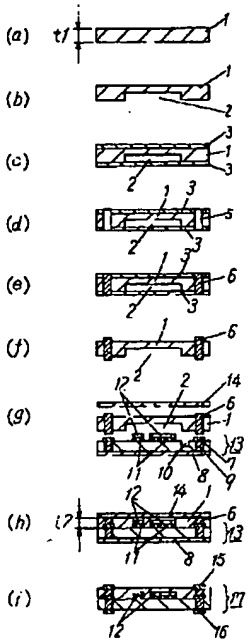
【図３】本発明の実施の形態３における、内部に部品素子を有する回路基板の製造工程を示す工程断面図

【図４】従来の回路基板の製造方法を示す工程断面図

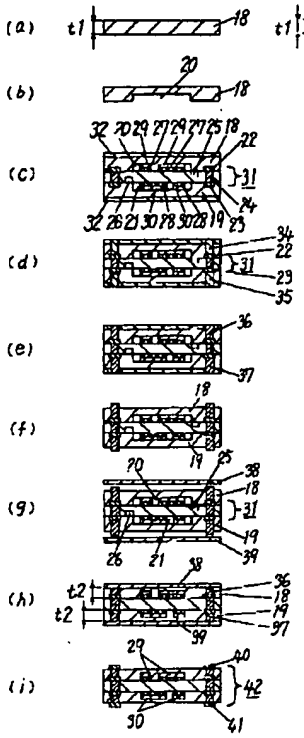
【符号の説明】

１　絶縁基材（アラミドーエポキシシート）
２　溝
３　離型性フィルム
５　貫通孔
６　導電性ペースト
７　配線パターン
８　金属箔
９　導電性ペースト
１０　溝
１１　配線パターン
１２　部品素子
１３　部品搭載基板
１４　金属箔
１５　配線パターン
１６　配線パターン
１７　４層回路基板
１８　絶縁基材（アラミドーエポキシシート）
１９　絶縁基材（アラミドーエポキシシート）
２０　溝
２１　溝
２２　第１の配線パターン
２３　第２の配線パターン
２４　導電性ペースト
２５　溝
２６　溝
２７　配線パターン
２８　配線パターン
２９　部品素子
３０　部品素子
３１　部品搭載基板
３２　離型性フィルム
３４　ビアホール
３５　ビアホール
３６　導電性ペースト
３７　導電性ペースト
３８　金属箔
３９　金属箔
４０　配線パターン
４１　配線パターン
４２　４層回路基板
５０　絶縁基材（アラミドーエポキシシート）
５１　溝
５２　離型性フィルム
５３　貫通孔
５４　導電性ペースト
５５　配線パターン
５６　金属箔
５７　配線パターン
５８　導電性ペースト
５９　配線パターン
６０　部品素子
６１　部品搭載基板
６２　溝
６３　配線パターン
６４　多層回路基板
１０１　離型性フィルム
１０２　絶縁基材
１０３　貫通孔
１０４　導電性ペースト
１０５　金属箔
１０６　配線パターン
１０７　回路基板

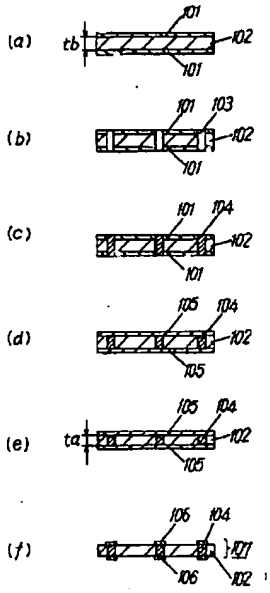
【図1】



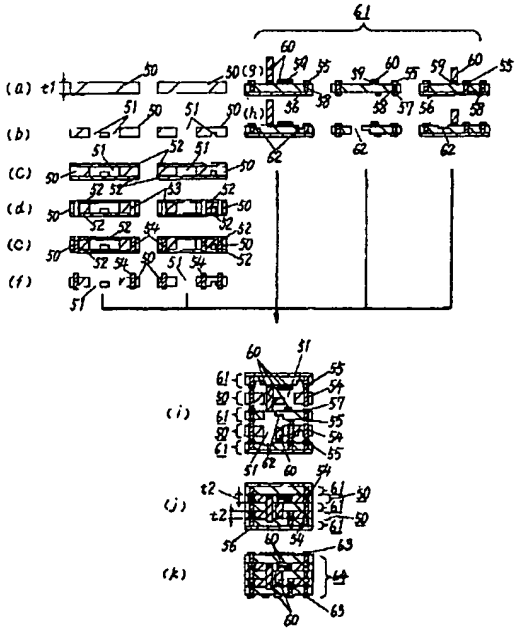
【図2】



【図4】



【図3】



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